

**REMARKS****I. Status of the Claims**

Claims 1-9, 12, 13, 15, 16 and 20-31 are pending. Claims 25-28 are allowed. Claims 5, 6 and 22 are objected to as depending from a rejected base claim but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 1-4, 7-9, 12, 13, 15, 16, 20, 21, 23, 24 and 29-31 are rejected. New claims 32-36 are presented above.

In the amendments above, Applicants have rewritten each of claims 5, 6 and 22 in independent form incorporating all of the limitations of the base claim and any intervening claims. The amendments to claims 5, 6, and 22 do not change the scope or content of these claims.

Applicants have also presented new claims 32-36. Claims 32, 33, 34, 35, and 36 are similar to claims 12, 13, 15, 24 and 16, respectively, except that claims 32, 33, 34, 35 and 36 each is directed solely to surface coating(s).

Applicants respectfully request entry of the amendments and remarks and reconsideration of the claims.

**II. Claims 12, 13, 15 and 24 Meet the Requirements of 35 U.S.C. 112, 2<sup>nd</sup> Paragraph**

Claims 12, 13, 15 and 24 are rejected under § 112, 2<sup>nd</sup> paragraph. The Examiner asserts that the limitation “molded article or surface coating” is indefinite. Applicants disagree with the Examiner and traverse the rejection in view of the amendments to the claims.

Claims 12, 13, 15 and 24 are written in the alternative and are directed to either molded articles or surface coatings. Notwithstanding this traversal, claims 12, 13, 15, 16 and 24 have been amended above to recite “molded articles.” New claims 32-36 have been added and are each directed to surface coating(s). Accordingly, the rejection is believed to be overcome in view of the amendments to claims 12, 13, 15 and 24.

**III. Claims 1, 3, 4, 7-9 are Patentable over Harmer**

Claims 1, 3, 4, and 7-9 are rejected under § 102(e) over Harmer. Applicants traverse the rejection.

Claims 1, 3, 4 and 7 each defines a certain process for the production of materials with interpenetrating inorganic and organic networks. Claim 8 defines materials with organic and inorganic networks which interpenetrate on a scale of no more than 100 nm and are obtained by a process according to Claim 1. Claim 9 defines Aerogel consisting of organic and inorganic networks interpenetrating on a scale of no more than 100 nm with a density of no more than 0.6 g/cm<sup>3</sup>. The specification of the instant application describes interpenetrating inorganic and organic networks in numerous instances. For example, in describing the organic network of the interpenetrating inorganic and organic networks, the specification states, for example, that

The organic polymer network is preferably obtained by polycondensation in the aqueous phase. Polymers and polymer precursors which can be polymerized by radical polymerization in the aqueous phase, however, can also be used. (First full paragraph on page 4).

It is preferred to select organic polymers, polymer precursors, or their mixtures which polycondense by adjustment of the pH value or the temperature to a value in the same range as that in which the inorganic ... network condenses. (Third full paragraph on page 4).

The expression “organic polymers, polymer precursors, or mixtures thereof” thus designates all the components which are required to obtain a polymer network in an aqueous solution or dispersion. In particular this expression includes polymers, prepolymers, monomers, crosslinking agents, and other substances which play a role in polymerization or crosslinking (lines 1-6 on page 5).

In describing the inorganic network of the interpenetrating organic and inorganic networks, the specification states, for example, that

The silicon dioxide components used according to the invention are components which can form polymeric networks in an aqueous solution. The preferred silicon dioxide components are water glass, laminar silicates, or silicic acids. Metal oxides which are suitable for the sol-gel technique are described in, for example, C.J. Brinker and G.W. Scherer: Sol-Gel Science, 1990, Chapters 2 and 3, Academic Press, Inc., New York. Free silicic acid is the preferred components which can be produced from water glass, for example, by separation of the cations by the use of ion-exchangers. A process of this type is described in, for example, EP-A 0,658,513. Free silicic acid from which the cations have been removed is highly compatible with organic polymers, polymer precursors, or mixtures thereof which can form polymer networks and can form stable sols and gels under a wide variety of conditions as a function of the pH value and concentration. (See page 5, first full paragraph).

The interpenetrating inorganic and organic networks described in the specification and claimed in claims 1, 3, 4 and 7-9 differ from the microcomposites disclosed in Harmer.

Harmer does not disclose the subject matter of any of claims 1, 3, 4 and 7-9. In particular, Harmer does not anticipate claims 1, 3, 4 and 7-9 at least for the reason that Harmer fails to disclose materials with interpenetrating organic and inorganic networks on a scale of no more than 100 nm and fails to disclose any process for the production of such materials. Instead, Harmer discloses a perfluorinated ion-exchange polymer (PFIEP) entrapped within a network of metal oxide. See Abstract. The microcomposite of Harmer consists of a continuous metal oxide phase that entraps a highly dispersed PFIEP within and throughout a connected network of porous channels. See Col. 7, lines 31-35. The microcomposite of Harmer does not have any interpenetrating organic and inorganic networks. In particular, the PFIEP of Harmer is not disclosed to be an interpenetrating organic network, as that term is used in the subject claims.

Instead, Harmer is merely representative of the traditional technology discussed in the background section of the instant application. For example, in describing US 5,342,876, the specification states at page 1, fourth full paragraph to page 2, line 4, that

US-A 5,342,876 describes a process for the production of porous, spherical particles of silicon dioxide. In this process, polyacrylamide polymers are used as a coagulation growth agent to promote the coagulation of the silica gels. Silica gel coagulates with a pore volume of 0.3-1.0 cm<sup>3</sup>/g are thus obtained. An interpenetrating network of silicon dioxide and polyacrylamide, however, is not formed, which means that the polyacrylamide can be dissolved out of the article produced.

Thus, Harmer does not disclose the interpenetrating organic and inorganic networks of claims 1, 3, 4 and 7-9, but instead discloses a microcomposite having an organic polymer entrapped within a metal oxide network. The microcomposite of Harmer includes a metal oxide network. It does not include an organic network and certainly does not include interpenetrating inorganic and organic networks.

For at least these reasons, Harmer fails to disclose the subject matter of any of claims 1, 3, 4 and 7-9. With reference to claim 1, Harmer fails to disclose a process for production of materials with interpenetrating organic and inorganic networks on a scale of no more than 100 nm by (1) mixing aqueous solutions or dispersions of organic polymers, polymer precursors, or mixtures thereof which are capable of forming polymer networks in the aqueous phase with silicon dioxide compounds; (2) changing the pH of and/or thermally treating the aqueous solution or dispersion to form a gel consisting of interpenetrating organic and silica gel networks; and (3) drying the gel. Thus, claim 1 is patentable over Harmer.

Each of claims 3, 4, and 7-8 depends directly or indirectly from claim 1 and is patentable over Harmer for at least the same reasons as claim 1 and for the additional element(s) recited therein.

With reference to independent claim 9, because Harmer fails to disclose any

interpenetrating organic and inorganic networks, Harmer necessarily fails to disclose aerogel consisting of organic and inorganic networks interpenetrating on a scale of no more than 100 nm with a density of no more than  $0.6 \text{ g/cm}^3$ . Thus, claim 9 is patentable over Harmer.

For the reasons stated above, Harmer does not anticipate any of claims 1, 3, 4, and 7-9. Applicants request withdrawal of the rejection and allowance of the claims.

**IV. Claims 2, 12, 13, 15, 16, 20, 21, 23, 24 and 29-31  
are Patentable over Harmer in view of Koloski**

Claims 2, 12, 13, 15, 16, 20, 21, 23, 24 and 29-31 are rejected under § 103(a) over Harmer in view of Koloski. Applicants respectfully traverse the rejection.

Harmer fails to teach or suggest interpenetrating organic and inorganic networks. The discussion above regarding Harmer is incorporated here by reference. Koloski does not cure the deficiencies of Harmer. That is, the combination of Harmer and Koloski fails to teach or suggest the subject matter of any of claims 2, 12, 13, 15, 16, 20, 21, 23, 24 and 29-31.

Instead, the composites of Koloski are similar to the microcomposites of Harmer in that each contains molecules infused into or entrapped within a matrix. Koloski teaches composites including a polymer matrix having an inorganic or organic material disposed in the natural free volume of the polymer matrix to provide a composite having similar properties as the native polymer matrix. See Abstract; Col. 4, lines 53-57. The composites of Koloski are made by evacuating the free volume of the polymer matrix and infusing inorganic and organic molecules into the evacuated free volume. See Col. 4, lines 40-43. Once the molecules are inside the free pore volume, the molecules are then polymerized. See Col. 4, lines 45-47. Polymerization of the infused molecules, however, is not taught or suggested to provide interpenetrating organic and inorganic networks. Instead, the infused material forms a network within the polymer matrix's natural free volume. See Col. 9, lines 19-21.

Thus, the combination of Harmer and Koloski fails to teach or suggest any interpenetrating organic and inorganic networks, and certainly does not teach or suggest the process defined by the subject claims for producing interpenetrating organic and inorganic networks. Each of claims 2, 12, and 13 depends directly or indirectly from claim 1 and is patentable over Harmer in combination with Koloski at least for the reasons stated above and for the additional element(s) recited therein.

Claim 9 defines an aerogel consisting of organic and inorganic networks interpenetrating on a scale of no more than 100 nm with a density of no more than  $0.6 \text{ g/cm}^3$ . As discussed above, Harmer fails to teach or suggest interpenetrating organic and inorganic networks and Koloski does not cure the deficiencies of Harmer, but instead Koloski teaches composites similar to the microcomposites of Harmer. Each of claims 15 and 16 depends directly or indirectly from claim 9 and is patentable over the combination of Harmer and Koloski for at least that reason and for the additional element(s) recited therein.

Claim 20 defines a process of producing materials, the process comprising: (a) providing organic and inorganic networks which interpenetrate on a scale of no more than 100 nm, the organic and inorganic networks which interpenetrate on a scale of no more than 100 nm produced by a method comprising: (1) mixing aqueous solutions or dispersions of organic polymers, polymer precursors, or mixtures thereof which are capable of forming polymer networks in the aqueous phase with silicon dioxide compounds, (2) changing the pH of and/or thermally treating the aqueous solution or dispersion to form a gel consisting of interpenetrating organic and silica gel networks, and (3) drying the gel; (b) producing materials using the gel, the materials comprising thermal insulation properties, sound absorption properties, adsorption properties and/or barrier properties against water and/or organic solvent. As discussed above, Harmer fails to teach or suggest interpenetrating organic and inorganic networks and Koloski does not cure the deficiencies of Harmer. Each of claims 21, 23 and 24 depends directly from claim 20 and is patentable over the

combination of Harmer and Koloski for that reason and for the additional element(s) recited therein.

Claim 29 is patentable over Harmer and Koloski because the citations fail to teach or suggest a process for the production of materials with interpenetrating organic and inorganic networks on a scale of no more than 100 nm by: (1) mixing aqueous solutions or dispersions of organic polymers, polymer precursors, or mixtures thereof which are capable of forming polymer networks in the aqueous phase with silicon dioxide compounds, wherein the organic polymers, polymer precursors, or mixtures thereof are formaldehyde or formaldehyde-containing resins, polyvinyl alcohol, or poly(meth)acrylates; (2) changing the pH of the aqueous solution or dispersion to form a gel consisting of interpenetrating organic and silica gel networks; and (3) drying the gel.

Claim 30 is patentable over Harmer and Koloski because the citations fail to teach or suggest a process for the production of materials with interpenetrating organic and inorganic networks on a scale of no more than 100 nm by: (1) mixing aqueous solutions or dispersions of organic polymers, polymer precursors, or mixtures thereof which are capable of forming polymer networks in the aqueous phase with silicon dioxide compounds, wherein the organic polymers, polymer precursors, or mixtures thereof are formaldehyde or formaldehyde-containing resins, polyvinyl alcohol, or poly(meth)acrylates; (2) thermally treating the aqueous solution or dispersion to form a gel consisting of interpenetrating organic and silica gel networks; and (3) drying the gel.

Claim 31 is patentable over Harmer and Koloski because the citations fail to teach or suggest a process for the production of materials with interpenetrating organic and inorganic networks on a scale of no more than 100 nm by: (1) mixing aqueous solutions or dispersions of organic polymers, polymer precursors, or mixtures thereof which are capable of forming polymer networks in the aqueous phase with silicon dioxide compounds, wherein the organic polymers, polymer precursors or mixtures thereof are selected from the group consisting of polyethylene glycol, carboxymethylcellulose, polyamides, polyvinylamines, bile acid

homopolymers, bile acid copolymers, bile acid oligomers, melamine resins, phenolic resins, resorcinol resins, melamine-formaldehyde resins, resorcinol-formaldehyde condensates and polyacrylic acids; (2) changing the pH of and/or thermally treating the aqueous solution or dispersion to form a gel consisting of interpenetrating organic and silica gel networks; and(3) drying the gel.

At least for the reasons provided above, claims 2, 12, 13, 15, 16, 20, 21, 23, 24 and 29-31 are patentable over the combination of Harmer and Koloski. Applicants request withdrawal of the rejection.

**V.     Claims 2, 4, 7, 9, 12, 13, 15, 20, 21, 23, 24 and 29-31  
       are Patentable over Harmer in view of Geiss**

Claims 2, 4, 7, 9, 12, 13, 15, 20, 21, 23, 24 and 29-31 are rejected under § 103(a) over Harmer in view of Geiss. Applicants respectfully traverse the rejection.

As discussed above, Harmer fails to teach or suggest interpenetrating organic and inorganic networks. Geiss does not cure the deficiencies of Harmer. That is, the combination of Harmer and Geiss fails to teach or suggest the subject matter of any of claims 2, 4, 7, 9, 12, 13, 15, 20, 21, 23, 24 and 29-31.

Instead, Geiss is directed to a composition comprising pre-formed aerogel particles and an aqueous binder. See Abstract. The aqueous binder disclosed in Geiss comprises at least one organic polymer and/or inorganic binder dispersed in water. The aqueous binder is added to the pre-formed aerogel particles. For example, Examples 1-3 of Geiss each discloses addition of pre-formed aerogel particles to an aqueous dispersion of styrene-acrylate copolymer. Example 4 discloses addition of pre-formed aerogel particles to an acrylate-vinyl-acetate-ethylene copolymer. None of the examples in Geiss are taught to provide interpenetrating organic and inorganic networks. In fact, the term network is not disclosed in Geiss.



For at least these reasons, the combination of Harmer and Geiss fails to render any of claims 2, 4, 7, 9, 12, 13, 15, 20, 21, 23, 24 and 29-31 obvious. In particular, the combination of Harmer and Geiss fails to teach or suggest any interpenetrating organic and inorganic networks, and certainly does not teach or suggest the process defined by claim 1 for producing interpenetrating organic and inorganic networks. Each of claims 2, 12, and 13 depends directly or indirectly from claim 1 and is patentable over Harmer in combination with Geiss at least for the reasons stated above and for the additional element(s) recited therein.

Claim 9 defines an aerogel consisting of organic and inorganic networks interpenetrating on a scale of no more than 100 nm with a density of no more than  $0.6 \text{ g/cm}^3$ . As discussed above, Harmer fails to teach or suggest interpenetrating organic and inorganic networks and Geiss does not cure the deficiencies of Harmer, but instead Geiss teaches pre-formed aerogel particles and an aqueous binder. Each of claims 15 and 16 depends directly or indirectly from claim 9 and is patentable over the citations for at least the reasons stated above and for the additional element(s) recited therein.

Claim 20 defines a process of producing materials, the process comprising: (a) providing organic and inorganic networks which interpenetrate on a scale of no more than 100 nm, the organic and inorganic networks which interpenetrate on a scale of no more than 100 nm produced by a method comprising: (1) mixing aqueous solutions or dispersions of organic polymers, polymer precursors, or mixtures thereof which are capable of forming polymer networks in the aqueous phase with silicon dioxide compounds, (2) changing the pH of and/or thermally treating the aqueous solution or dispersion to form a gel consisting of interpenetrating organic and silica gel networks, and (3) drying the gel; (b) producing materials using the gel, the materials comprising thermal insulation properties, sound absorption properties, adsorption properties and/or barrier properties against water and/or organic solvent. As discussed above, Harmer fails to teach or suggest interpenetrating organic and inorganic networks and Geiss does not cure the deficiencies of Harmer. Each of

claims 21, 23 and 24 depends directly from claim 20 and is patentable over the combination of Harmer and Geiss for that reason and for the additional element(s) recited therein.

Claim 29 is patentable over the citations because the citations fail to teach or suggest a process for the production of materials with interpenetrating organic and inorganic networks on a scale of no more than 100 nm by: (1) mixing aqueous solutions or dispersions of organic polymers, polymer precursors, or mixtures thereof which are capable of forming polymer networks in the aqueous phase with silicon dioxide compounds, wherein the organic polymers, polymer precursors, or mixtures thereof are formaldehyde or formaldehyde-containing resins, polyvinyl alcohol, or poly(meth)acrylates; (2) changing the pH of the aqueous solution or dispersion to form a gel consisting of interpenetrating organic and silica gel networks; and (3) drying the gel.

Claim 30 is patentable over the citations because the citations fail to teach or suggest a process for the production of materials with interpenetrating organic and inorganic networks on a scale of no more than 100 nm by: (1) mixing aqueous solutions or dispersions of organic polymers, polymer precursors, or mixtures thereof which are capable of forming polymer networks in the aqueous phase with silicon dioxide compounds, wherein the organic polymers, polymer precursors, or mixtures thereof are formaldehyde or formaldehyde-containing resins, polyvinyl alcohol, or poly(meth)acrylates; (2) thermally treating the aqueous solution or dispersion to form a gel consisting of interpenetrating organic and silica gel networks; and (3) drying the gel.

Claim 31 is patentable over the citations because the citations fail to teach or suggest a process for the production of materials with interpenetrating organic and inorganic networks on a scale of no more than 100 nm by: (1) mixing aqueous solutions or dispersions of organic polymers, polymer precursors, or mixtures thereof which are capable of forming polymer networks in the aqueous phase with silicon dioxide compounds, wherein the organic polymers, polymer precursors or mixtures thereof are selected from the group consisting of polyethylene glycol, carboxymethylcellulose, polyamides, polyvinylamines, bile acid

homopolymers, bile acid copolymers, bile acid oligomers, melamine resins, phenolic resins, resorcinol resins, melamine-formaldehyde resins, resorcinol-formaldehyde condensates and polyacrylic acids; (2) changing the pH of and/or thermally treating the aqueous solution or dispersion to form a gel consisting of interpenetrating organic and silica gel networks; and (3) drying the gel.

At least for the reasons provided above, claims 2, 12, 13, 15, 16, 20, 21, 23, 24 and 29-31 are patentable over the combination of Harmer and Geiss. Applicants request withdrawal of the rejection.

**VI. Claims 25-28 are Allowed**

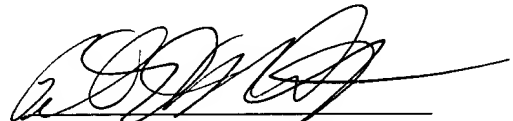
Claims 25-28 are allowed. Applicants appreciate the Examiner's acknowledgment that claims 25-28 are patentable.

**VII. Conclusion**

For the foregoing reasons, all claims pending in the application are in condition for allowance. Applicants respectfully request allowance of all claims.

Respectfully submitted,  
Sievers et al.

29 Oct 2003  
Date

  
Peter D. McDermott (Reg. No. 29,411)  
Attorney for Applicants  
Banner & Witcoff, LTD  
28 State St. - 28th Floor  
Boston, MA 02109  
Phone: 617.720.9600  
Fax: 617.720.9601